REMARKS/ARGUMENTS:

An IDS is attached submitted citing a reference (US 2002/0114378 A1 to Yue) first disclosed in companion PCT Application Serial No. PCT/IB04/01566 by an international search report and written opinion dated Feb. 8, 2005 and issued by the ISA/US. Other references cited in that companion PCT case are already of record in this US application. For fee purposes, the ISA/US is considered a "foreign patent office" and the companion PCT application is considered a "counterpart foreign application" as recited in 37 CFR 1.97 (e) (1) and MPEP 609, so no fee is included for the IDS to be considered.

Claims 1-40 are pending in this Application, wherein claims 33-40 are newly added. In the Office Action dated January 5th, 2005, the Examiner has rejected claims 1-8, 12-13, 23-28 and 32 as anticipated by Jafarkhani (US 2001/0031019 A1); has rejected claims 9-10 and 29-30 as obvious over Jafarkhani in view of Lo (US 2003/0123877 A1); has rejected claims 11, 14-15, 17-22 and 31 as obvious over Jafarkhani in view of Falzon (US 2003/0210824 A1); and has rejected claim 16 as obvious over Jafarkhani in view of Falzon and Lo. The independent claims include claims 1 (a space-time signal constellation), 13 (a symbol detection method), and 23 (a network element that stores a representation of a signal constellation), as well as new claim 37.

Claims 4 and 25 are amended so as not to imply that the planes are physical bodies; they may be virtual geometric constructs. This is seen as a clarifying amendment, not mandated under 35 USC 112 and therefore not done for reasons related to patentability. It is made to preclude a potential adverse argument during enforcement after patent issue.

Support for claims 33 and 35-36 is at page 18, lines 25-29. If a constellation point lies at the origin or geometric center of a sphere, it may or may not also lie within a (n-1) real dimensioned sub-constellation. Support for claim 34 is within claims 1, 14 and 23. Claims 37-40 are means plus function claims that draw support from claim 13.

Rejections under 35 USC 102:

Broadly, Jafarkhani is directed to differential decoding of block space-time codes that exhibit generally orthogonal designs with conventional constellation points as the matrix entries. Jafarkhani assumes that the receiver has no channel state information available, so

it is a non-coherent system. Conversely, the present application is directed to a constellation itself and the design of it for partially coherent systems, with entries from the set of complex numbers and not from a finite conventional constellation. As detailed in the written description, channel state information is employed at the receiver, but estimation errors are also taken into account for constellation design and detection.

Respecting the specific language of the pending claims, claims 1, 13 and 23 recite a constellation that has a plurality of points disposed among n real dimensions. The number of real dimensions must be an even number, as n=2M and M is an integer. Claims 13 and 23, as well as dependent claims 14 and 34, further recite that each of the plurality of points is within only one (n-1) dimensioned sub-constellation (there being at least two such sub-constellations in the overall constellation). Thus, each sub-constellation must have an odd number of real dimensions that is one less than that of the overall constellation.

The Jafarkhani reference is not seen to detail a particular orientation of constellation points, which Jafarkhani defines at paras. 0018 and 0023 as having 2^b elements, and some of those elements make up the four transmitted constellation signals, which are denoted as s_1, s_2, s_3, and s_4. at paras. 0017-0025. The constellation points that Jafarkhani transmits are sent over n transmit antennas (para. 0012), and Jafarkhani is seen to use the variable k to represent dimensions of a unit (sic) circle on which lie a set $\mathcal{P}$ of constellation points to be transmitted (para. 0028). Jafarkhani also recites that the variable k is the number of constellation signals to be transmitted (paras. 0018, s_k; and 0045). The set $\mathcal{P}$ of constellation points is not the overall signal constellation but only those constellation points selected to be transmitted in the block. In Jafarkhani's example described over paras. 0015 and 0026, k=4 because four signals, s_1, s_2, s_3, and s_4, are being transmitted in the block, and there are four transmit antennas (para. 0017). If the set $\mathcal{P}$ is taken to be a sub-constellation, Jafarkhani does not indicate in how many real dimensions it lies, whereas claims 1, 23, 14 and 34 recite that the sub-constellations have (n-1) real dimensions. If the Office Action presumes the sub-constellations are arbitrary, the independent claims relate that each point of the plurality lies in only one sub-constellation, and new claims 33 and 35-36 recite that all points of the constellation, or alternatively all points save one, lie in a sub-constellation.

If by citing para. 0050 the Office Action asserts that the number of real dimensions of the overall Jafarkhani constellation is given by the variable k, then that same paragraph states that the number of Jafarkhani transmit antennas n equals four (also stated at para. 0017) and the variable k is also equal to four. However, claims 2 and 13 each recite that M is the number of transmit antennas, and the real dimensions of the constellation is n=2M. If instead the Office Action is taken to assert that the set $\mathcal{P}$ represents a sub-constellation with k real dimensions, then Jafarkhani's statement that k=4 in para. 0050 cannot anticipate the claimed (n-1) real dimensions for a sub-constellation, because the claim element n=2M mandates that n is an even number and (n-1) is necessarily an odd one.

The dependent claims are similarly not disclosed in or inherent to Jafarkhani. As to claims 4 and 25, the Office Action appears to consider that transmission by separate antennas results in transmitting separate signal constellations in parallel to one another. Notwithstanding that the k-dimensional unit circle of Jafarkhani's para. 0028 is seen as a mathematical construct and not a representation of the constellation, claim 1 recites a signal constellation embodied on a storage media. Even if the other recited elements were met by virtual signals passing through a wireless channel as the Office Action seems to imply, claims 1 and 23 are anticipated only where those elements are met by a constellation embodied on a storage medium. Claim 13 recites that data samples are fitted to a signal constellation, which they cannot be if the claimed elements of the signal constellation exist only in transit over a channel and represent the source of the data sample itself.

As to claims 5-8 and 26-27, the Office Action seems to equate the k-dimensional unit circle at Jafarkhani's para. 0028 with the claimed constellation subsets each defining n real dimensions. When drafting the application, the undersigned purposefully distinguished the term sub-constellation from the term subset, and that distinction is clear as claimed in the different numbers of real dimensions. If the Office Action asserts that Jafarkhani's variable k represents the number of real dimensions in both the overall constellation, then construing transmission of the same k-dimensional unit circle from Jafarkhani para. 0028 by multiple antennas as transmitting parallel sub-constellations necessarily fails to meet the (n-1) real dimension sub-constellation element of claims 1, 13 and 23. If the transmissions from the different antennas are considered different subsets (each subset in

claims 7 and 27 having n real dimensions, the same as the overall constellation), then the overall constellation would necessarily have more than n real dimensions because the purported subsets are transmitted by multiple antennas. Either construct of Jafarkhani violates the element of the independent claims that the point lie on one and only one sub-constellation: construing transmissions by different antennas as different sub-constellations necessarily places the same constellation point transmitted by two different antennas (as Jafarkhani does) on two different sub-constellations in violation of the claim element that the points lie on one and only one sub-constellation.

Further, claims 5 and 26 each recite an axis of symmetry, and claims 8, 15 and 28 recite a closed arcuate surface, none of which is seen to be disclosed by or inherent in Jafarkhani (claims 15 and 28 are rejected as obvious, but the Office Action remarks cite the elements particular to those claims as within Jafarkhani).

In considering Jafarkhani, it is noted that the present claims are directed to a signal constellation, and Jafarkhani includes no diagrams of signal constellations and is not seen to refer to a specific known signal constellation in the text. In the current application, exemplary sub-constellations are indicated by the points lying on the parallel planes in Fig. 2B, and the subsets are indicated by points lying on concentric spheres in Fig. 2B. Jafarkhani is not seen to include teachings that anticipate the sub-constellations or subsets of constellation points as claimed.

Rejections under 35 USC 103:

Lo is directed to three-dimensional modulation using polarization of signals. While certain of the Lo figures may resemble those of the present application, the concepts are not seen as being analogous. In the present invention, additional dimensions come from jointly modulating signals for multiple antennas, where operations for each transmit antenna adds two real dimensions. The present claims preclude a three-dimensional constellation because the number n of real dimensions equals 2M, so n must be an even number. The figures illustrate a three dimensional constellation to explain the recursive constellation construction described in the present application, as it is not seen how to illustrate four real dimensions on a two-dimensional drawing sheet (see the written description at page 18, lines 1-7). The Office Action appears to cite Lo only for its

disclosure of constellation points disposed about a concentric spherical surface, which it does. However, Lo is not seen to disclose mutually exclusive sub-constellations each having one less real dimension than the overall constellation, or an n=2M real-dimensioned constellation.

Falzon is directed to data compression using orthogonal or bi-orthogonal base functions such as wavelets. Falzon uses a Kullback-Leibler (KL) distance to estimate the parameters of a generalized Gaussian distribution, which in turn is used as a probability density model of the sub-bands. However, claims 11, 14-15, and 31 do not recite that the KL distance is a distance metric between distributions; they recite that a maximized minimum KL distance separates certain points of a signal constellation. The KL distance of those claims is used in the design of the signal constellation, so the distance between points of adjacent subsets in the embodied constellation that was so designed inherently reflects a KL distance. Falzon is not seen to use KL distance between constellation points.

For the above reasons, the amended claims are seen to be novel and non-obvious over the cited art, and the Examiner is respectfully requested to pass claims 1-40 to issue. The undersigned representative welcomes the opportunity to resolve any formalities or other matters that may remain via teleconference, at the Examiner's discretion.

Respectfully submitted:

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